Rational Expectations in Agricultural Models: A Critical Review of the Concept and Its Use

The role of anticipations on the part of economic agents as they attempt to solve the many economic decision problems which they face has been of serious interest to economists for decades. Anticipations of future events formed a cornerstone of J.R. Hicks theories of capital and economic motivation (Hicks). In that seminal work, agents anticipations or expectations of the future levels of prices, interest rates etc. were central to understanding economic motivation and ultimately economic choice. The concept of anticipation as a phycological phenomenom gradually gave way to the the equating of anticipations with expectations as defined by the statistical concept. Various 'models' and hypotheses of expectations formation were advanced and incorporated in the existing literature on economic models. Various forms of expectations were labeled naive, extrapolative, adaptive and rational. Each of these differing from the preceding by the amount of information one assumes is required to form the particular expectation at hand. Naive requiring only a single past observation on the variable in question while rational requires "all the relevant economic and non-economic information" at hand. With the work of Muth (1961) and the subsequent clarifications and extensions of the concept of "rationally" formed expectations by Hanson and Sargent (1983), Wallis (1980,1981), Fisher (1982), and many others, rational expectations has become a central feature in many econometric modeling exercises.

Also coupled with the development of rational expectations has been the work of Lucas(1976) on the appropriate methods whereby exogenous policy variable changes may be incorporated into econometric models. The Lucas Critique, as it has been termed, argues that proper econometric policy modeling must account explicitly for the interaction between the estimated reduced form parameters and the parameters of the policy variable prediction processes used by the economic agents characterized by the model. Failure to separate the parameters of the reduced form from those of the policy process will yield predictions which are in error when alternative policies are evaluated which imply new policy variable generating rules.

In the decade of the 70's substantial interest has been generated concerning the appropriate manner in which to construct econometric models which exhibit "rational" expectations and are useful in alternative policy evaluations. Much of this work in the economics literature has been devoted to exploration of whether or not expectations are actually "rational" (Bray, Cyert and DeGroot, DeCanio, Frydman, Grossman). The econometrics literature has been filled with papers on the appropriate models and estimation techniques to empirically test the hypothesis (Wallis, 1980, Hoffman and Schmidt, Hoffman and Schlagenhauf). Agricultural economists have also joined the band wagon with an ever increasing amount of research focusing on the inclusion of rational expectations in many different supply/demand models (Goodwin and Sheffrin, Huntzinger, Fisher, Nerlove, 1979).

However, one cannot review much of the agricultural economics literature without the nagging suspicion that the inclusion of the rational expectations hypothesis is based on a too optimistic and uncritical view of the strengths and weaknesses of the hypothesis. Some have argued that sound agricultural policy modeling is synonymous with rational expectations without considering whether such an expectational hypothesis is plausible or even necessary to the Lucas critique (Fisher, p. 261). In particular, the frequency with which one can find the same well turned phrase relating to the virtues of the hypothesis from one article to another not to mention the dirth of well balanced references in these articles suggests that agricultural economists are in the process of embracing this hypothesis with the same amount of uncritical zeal with which the now out-of-favor adaptive hypothesis was once generally proclaimed.

The purpose of this paper is to review the concept and selective claims of the rational expectations hypothesis, both as a plausible model of anticipations and as a useful tool in applied agricultural policy analysis, and to review the empirical evidence as to the verifiable existence of rational expectations formation in agricultural and other economic markets. The conclusion of this paper is that the rationality hypothesis, although alluring on the face of it's logic and algebraic simplicity, requires the acceptance of too many unsubstantiated attributes of human perception to be accepted uncritically in agricultural supply and policy models. In fact, it is argued that in policy models, the Lucas critique is not synonymous with the rationality hypothesis.

Since the work of Muth the literature focusing on the rational expectations hypothesis has grown considerably. The review presented here is not intended to be exhaustive of this literature. However, it is the author's belief that it is representative of the conceptual and empirical evidence to date.

RATIONAL EXPECTATIONS IN CONCEPT

Consider the following general simultaneous equations model as presented in one form or another by Wallis (1980) and more recently Fisher (1982).

(1)... $By_t + Ay^*_t + T_1 \; x^*_{1,t} + T_1 \; x_{2,t} = u_t$

where y_t is a vector of g endogenous variables, y^*_t is a vector of g expected endogenous variables, $x^*_{1,t}$ is a vector of k_1 expected exogenous variables, and $x_{2,t}$ is a vector of known predetermined or exogenous variables.

Note that $x^*_{1,t}$, or $x_{2,t}$ may or may not contain policy variables which are either expected or known depending on the the relevant theoretical considerations used to develop the model. $X^*_{1,t}$ and $x_{2,t}$ may also contain the actual realization of a variable and its expected value if it is believed that both variables influence the level of the dependent variable. Also note that at this point the variables y^*_t and $x^*_{1,t}$ must really be defined as anticipations on the part of agents. Anticipations which may or may not be isomorphic transformations of statistical expectations. This is an important point to which I will return later in the paper. B, A, T_1, T_2, have dimensions (g x g), (g x g),(g x k_1), and (g x (k-k_1)), respectively. Note that not all of the endogenous variables in the system need enter as expectations in which case the corresponding columns of the square matrix A will be identically zero.

This system can be routinely solved for the implied rationally anticipated vector y^*_t as:

(2)... $E(By_t) = E(-Ay^*_t) - E(T_1 x^*_{1,t} - T_2 x_{2,t} + u_t.)$

(3)... $y^*_t = -(B+A)^{-1} T_1 x^*_{1,t} - (B+A)^{-1} T_{2,t} x_{2,t}.$

The reduced form system for (1) can then be easily written as:

(4)... $$y_t = B^{-1} A(B+A)^{-1} - B^{-1} T_1)x^*_1$$
$$+ (B^{-1} A(B+A)^{-1} - B^{-1} T_2)x_2 + B^{-1} u_t.$$

Plausibility of Rational Forecasts

Examination of equation (2) clearly illustrates a major criticism which has been directed at the "optimality" of the rational expectations hypothesis by Frydman (1982,1984) and others. In equation (2) it is apparent that the individual rational expectation $E(By_t)$ is a function of the average of expectations $E(-Ay^*_t)$ of all agents in the market. The implication of simply moving $E(-Ay^*_t)$ from the right hand side of (2) to the left is to postulate that every individual agent knows the behavioral parameters of the other agents in the market. As Frydman demonstrates, it is not likely that economic agents can ascertain the average expectation of other market participants in decentralized markets yet this is required if rational expectations is to have any operational meaning. Moreover, Frydman demonstrates that in a market characterized by a large number of producers, operating as price takers in a highly decentralized market which is very similar to that which characterizes agricultural markets, producers cannot learn the relevant parameters of the rational expectations equilibrium and cannot form rational forecast functions. This point is generally overlooked in the applied agricultural economics literature.

Agricultural Policy and the Lucas Critique

The implications of rational expectations and the Lucas critique can be clearly addressed by considering equations (3) and (4). From (3) we can see that if expectations are formed according to the rational expectations hypothesis the structure of those expectations is determined by the structure of the model, i.e., the matrices B, A, T_1, T_2, as well the structure inherent in the expectations process for the vector $x^*_{1,t}$. When Muth wrote in 1961 "that the expectations of firms tend to be distributed about the prediction of the theory" he was asserting that (3) is the equilibrium forecasting function used by economic agents and that on the average they know with certainty the parameters embodied in the compound matrices in (3).

Note, however, that this does not say anything about the structure of the expectations processes used to predict $x^*_{1,t}$, some of which may be policy variables. Indeed, it is usually assumed that these processes are derived as some variant of a optimal statistical predictor based on own past information, and do not have the form or structure of a rationally formed expectation (Fisher).

Alternatively, if we were to assume that expectations are formed by a much more simple process such as naive expectations:

(5)... $y^*_t = y_{t-1}$,

we find that (4) reduces to:

(6)... $y_t = - B^{-1}Ay_{t-1} - B^{-1}T_1 \, x^*_{1,t} - B^{-1}T_2x_{2,t} + B^{-1}u_t$.

Obviously, under this specification, equations (4) and (6) are not the same. Even though we have not postulated a rational expectations model for equation (6), we still have to be aware that the structure of the expectations on the vector $x^*_{1,t}$, some of which may be policy variables influences the behavior of the complete system through the structural matrices B^{-1}, and T_1. Similar conclusions can be drawn if we assume that expectations are formed adaptively.

Given that our primary interest is to identify the linkages between the behavior of the system or specific endogenous variables in the system and alternative processes for generating the policy variables contained in the vector $x^*_{1,t}$, we need to explicitly consider how the expectations $x^*_{1,t} = E(x_{1,t} \,/\, \Omega_{t-1})$ where Ω_{t-1} is the as yet unspecified information set, can be formulated. Obviously, we could (and maybe should) argue that producers are as politically astute as they are economically and model $x^*_{1,t}$ as an endogenous component of a complete simultaneous equation political system. For even more obvious reasons this has not been the standard practice in either the expository or empirical rational expectations literature.

The traditional approach is to postulate that the process generating each of the variables in the vector $x^*_{1,t}$ can be characterized and modeled as a univarate stochastic process, in which the relevant information comprising $E(x_{1,ty} \,/\, \Omega_{t-1})$ is only the past levels of $x_{1,t}$ (Fisher, Nerlove, et al., 1980; Wallis, 1980). This of course assumes that there is not a set of variables outside the model and independent of the model's error structure which helps forecast the elements of the vector $x^*_{1,t}$. This may not be a very useful nor accurate presumption when most policy variables are designed to explicitly impact on the behavior of the system of which they are a part and will most usually be linked in some manner to the past behavior of the system itself, a point which is considered explicitly in much of the macroeconomics literature but which seems to be somewhat overlooked in the agricultural economics literature.

Ignoring this last somewhat troublesome point for the time being, we can proceed by assuming a very general form for the stochastic process generating the variables in the expectations vector $x^*_{1,t}$. Assume that this process takes the form of a vector autoregressive moving average (ARMA) model for $x_{1,t}$:

$$(7)\ldots\ \phi(L)x_{1,t} = \Theta\ (L)\ \xi_t$$

where ξ_t is a white noise process independent of u_t, and $\phi(L)$ and $\Theta(L)$ are polynomials in the lag operator L of degree p and q, respectively, vis.,

$$\phi(L) = I + \phi_1 L + \ldots + \phi_p L^p \quad ; \ \Theta(L) = I + \Theta_1 L + \ldots + \Theta_q L^q$$

As Wallis (1981) has demonstrated, normalization of the moving average side of (7) can be achieved in many ways, each of which has specific implications for the final form of the reduced form equations (3).

The standard approach is to express (7) as an infinite autoregressive representation based on the expansion:

$$(8)\ldots\ \phi(L)X_t \big/ \Theta(L) = I - \left[\frac{\Theta(L) - \phi(L)}{\Theta(L)}\right]\ X_t = \xi_t$$

which gives us the optimal predictor:

$$(9)\ldots\ x_{1,t} = \Psi(L)\ x_{1,t-1}\ ,$$

where the substitution of (9) into the reduced from equation (4) yields the final form equations. Each endogenous variable is given as a distributed lag function of the exogenous variables:

$$(10)\ldots\ y_t = (B^{-1}A(B+A)^{-1} - B^{-1}T_1)\ \Psi(L)x_{1,t-1} + (B^{-1}A(B+A)^{-1} - B^{-1}T_2)x_{2,t} + B^{-1}u_t\ .$$

Any change in the process by which the variables in the vector $x^*_{1,t}$ are generated, which by assumption would occur in the event of a policy change, will alter the parameters of the complex polynomial $\Psi(L)$ and the reduced form coefficients given by:

$$(11)\ldots\ TT_1 = (B^{-1}A(B+A)^{-1} - B^{-1}T_1)\ \Psi(L).$$

An important point to notice is that these same policy implications hold for other endogenous expectations models as well.

For example if we assume that producers naively form expectations on the endogenous variables in the system and forecast optimally in the minimum mean squared error sense (MMSE) the expected values of the exogenous variables, some of which may be policy variables, we can specify (10) as:

$$(12)\ldots\ y_t = -B^{-1}A\ y_{t-1} - (B^{-1}T_1)\ \Psi(L)x_{1,t-1} - B^{-1}\ T_2x_{2,t} + B^{-1}\ u_t.$$

Obviously, the Lucas Critique holds for this model as well. Any change in the parameters of the polynomial $\Psi(L)$ will also alter the reduced form coefficients given by:

$$(13)\ldots\ TT_2 = (B^{-1}T_1)\ \Psi(L).$$

The same conclusion can be demonstrated for adaptive expectations models. From this it is apparent that the Lucas critique is pertinent to policy modeling regardless of the hypothesized expectations model, as long as the policy environment is taken to be exogenous to the system (1) as is usually the case.

The preceding development raises the question of whether or not it is possible to distinguish between the specification of a model in which rational expectations are postulated versus some other formulation such naive expectations and indeed whether it is at all important in applied policy modeling. A central feature of the REH formulation of a model is the existence of a number of within and cross-equation parameter restrictions which are unique to the model specification and REH. It is common practice to rely on statistical tests of these restrictions as a means of supporting the REH or rejecting it in empirical work.

In answer to the first question I would argue that in applied policy modeling it is difficult to distinguish between either structural or final form specifications as implied by the various expectations models. Because of the large number of normalizations on the stochastic process for the vector $x^*_{1,t}$ it is possible to generate final form equations with an almost limitless specification form in terms of the included right hand side variables.

For example as Wallis (1981) has shown, the presence of a ARMA (p,q) model for the vector $x^*_{1,t}$, with a normalization expressing $x^*_{1,t}$ in its pure autoregressive form will result in a final form system which includes as right hand side variables a distributed lag on the endogenous variables of order q, and a distributed lag on the $x_{1,t}$ variables of order max(p,q).

If we chose p=q=1, then we have a rational expectations final form system which is identical to that generated by the naive expectations (6) with a simple ARMA(1,0) model for the vector $x^*_{1,t}$. In general if we postulate an ARMA(p,q) process for the vector $x^*_{1,t}$ with p>1 and q>1 we can generate a rational expectations final form which is equivalent to that generate by the adaptive expectations hypothesis (Wallis, 1981). The inclusion of other structural properties into the model such as biological lags or cost of capital adjustment which lead independently to dynamic final form equations increases the difficulty of disentangling the underlying parameters and hence testing the model specification from the expectations specification.

Because of the non-uniqness of the normalization one wishes to choose for the stochastic processes included in the model, statistical tests of the parametric restrictions are jointly tests of the model specification, the normalization chosen and the REH, a point carefully considered by Hoffman and Schlagenhuaf. An acceptance or rejection can relate to any or all of these joint hypotheses simultaneously. Even though it may be very difficult to identify and empirically substantiate the exact type of expectations formulation being used by producers in applied policy modeling, I would argue that it is not really important to do so.

As the preceeding development hopefully has demonstrated, we must not ignore how changes in the policy structure will alter our parameter estimates when we evaluate alternative policies irrespective of what we want to assume about the rationality of the producers expectations mechanisms.

Anticipations vs. Conditional Expectations: A Final Argument

In setting up the definition of rational expectations, Muth took the position that economic agents unobserved anticipation of the level of an economic variable such as market price could be represented by the mathematical conditional expectation of that variable given the parameters of the underlying economic system. In fact he went beyond this to argue that this anticipation was in fact equivalent to the conditional expectation. Progressing from equation (1) wherein the vector y^*t is most appropriately defined in terms of unknown anticipations to equation (4) requires that we uncritically accept this transformation.

We may in fact question the validity of such an argument. Asserting that the mechanics of human perception are equivalent to those of mathematical expectation is to maintain that the theory of human perception and mathematical statistics are isomorphic (Brodbeck). We know very little about the theory of human perception as it pertains to economics so it is convenient to substitute the concepts, laws and constants from a more widely known theory. However, without proper verification that this correspondence is in fact one-to-one, it becomes difficult to assess the validity of tests of the rational expectations hypothesis. Such tests are jointly tests of the particular structure employed by the econometrician and the degree to which one can replace such concepts as anticipation with mathematical expectation. This latter test is, to the authors knowledge, almost completely ignored in the rational expectations literature. Where attempts have been made to verify the existence of such an isomorphic correspondence in general very little support has been found for the hypothesis (Slovic, Tversky and Kahneman, Goldberg, Slovic, Fischhoff and Lichtenstein).

REVIEW OF SELECTED EMPIRICAL EVIDENCE

Much of the literature in the agricultural journals which considers the rational expectations hypothesis has been either conceptual or expository in nature. However some authors have attempted to test hypothesis in various agricultural markets. Also, the non-agricultural economics literature has produced many more attempts at verification.

One of the earliest applied rational expectations papers to appear in the agricultural economics literature was presented by Shonkwiler and Spreen (1983). In this paper the authors present a closed-form macro-model of the Florida Escarole lettuce market. The model is set up as a four equation system with an acreage, yield, demand and a market clearing identity. Three expectations formulations are derived and incorporated in to the model. These are a dynamic cobweb, rational, and a mixed version of the first two. The authors argue that the mixed version should increase the flexibility of the model. Expectations on the exogenous variable were modeled as either deterministic polynomials or as ARMA processes normalized as pure autoregressive processes. Each of these models was estimated by a nonlinear three-stage least squares procedure. The authors conclude

> "The results...do not support the postulate of rational expectations as it is used in the acreage equation. ... In addition, the parameter restrictions imposed across equations by the acreage equation using both rational and mixed expectations result in marginally poorer structural fits for the associated yield and demand equations relative to the dynamic cobweb model...These findings strongly suggest that the rational expectations hypothesis is not appropriate for modeling supply response in the Florida escarole market."

A second study by Shonkwiler and Emerson focused on the Florida winter tomato market. In this paper, the authors develop a four equation supply and demand model of the winter tomato market in Florida. The model consists of an acreage, yield, demand and market clearing equations.

Rational expectations are incorporated into the model by solving for the expected market clearing price and generating the observable reduced form. Expectations on exogenous variables are handled in the usual way by assuming that they can be modeled as ARIMA processes. In addition to the rational model, the authors test a cobweb model by using lagged price as the expectation. Full information maximum likelihood is applied to estimate the parameters subject to the implied cross-equation restrictions. The authors also incorporate a test suggested by Revenkar which nests a restricted rational expectations hypothesis in the more general framework.

The conclusion reached by the authors is that:

> "the rational expectations specification is consistent with the data for the winter tomato market. Moreover, the results suggest superior performance in interpreting acreage decisions than for the more typical cobweb model".

It should be pointed out that in the particular model formulation chosen by the authors, they include a one period lag on the acreage variable thus claiming that the model is dynamic. This may in fact lead to substantial difficulties of interpretation of the specification vs. expectations tests (Wallis, 1981, Hoffman and Schlagenhauf).

In a more recent effort at testing the rational expectations hypothesis as it applies to agricultural markets, Goodwin and Sheffrin apply the concept to the U.S. broiler market. Their model is similar to that presented by Huntzinger. The model includes an aggregate supply and demand equation along with a market clearing identity. Rational expectations are included in the usual way. Exogenous expectations are treated as ARIMA forecasts and included in the model as observed data. As with most studies of this type, the equations relating to the market under scrutiny and the exogenous forecasts are estimated separately. As a novel approach to the problem, Goodwin and Sheffrin estimate a purely univarite ARIMA model of broiler prices and then compare the forecast error of this against the forecast error derived from the conditional expectations on broiler price using the full model. It is argued that if expectations are formed rationally then the later should have a smaller forecast error variance. The rationality hypothesis is tested by use of a likelihood ratio test on the overidentifying restrictions implied by the hypothesis. As an additional test, the authors include the futures price for iced broilers into the rational price forecasting equation to determine if this additional information adds significantly to forecasting broiler prices.

On the basis of these three somewhat disparet tests, the authors conclude that U.S. broiler supply is in accord with the rational expectations hypothesis. It should be pointed out that the authors do explicitly recognize that the likelihood test is jointly a test of the rationality assumption and the model specification. Also, the fact that the reduced form equation on broiler price has a significantly smaller forecast error variance than the univarate ARIMA or model does not provide evidence that broiler producers form expectations rationally. All that can be concluded contrary to the authors claims, is that the inclusion of the additional information from their structural model is in fact useful in reducing forecast error (Frydman, 1982).

Turning now from agricultural models to more general economic models, Jones and Roley test the rationality hypothesis in a model of the term structure for three and six month Treasury bills. This hypothesis is jointly tested with the hypothesis that the term structure accurately represents equilibrium yields. As such it was not possible to separate these two hypothesis. The authors conclude that:

> "The empirical results indicated that the null hypothesis that investors form their expectations rationally and the expectations model of the term structure accurately represents equilibrium yields could be rejected at an extremely low significance level."

In the previous studies rationality of expectations is tested for in an indirect method. That is, the tests of the hypothesis are based on the within and cross-equation restrictions implied by the hypothesis. A direct test would focus directly on whether or not expectations met the unbiasedness condition and whether or not the forecast error was strictly independent of the pertinent information set used to form the expectation. In the following two studies, rationality is tested directly, using actual observed expectations of some economic variable.

In an early study of this type, Turnovsky (1970) investigates the empirical evidence on the structure of price expectations in the United States during the post-Korean War period. Turnovsky utilizes the well known Joseph A. Livingston expectations data published in the

Philadelphia Bulletin. The data consists of six and twelve month expectations on the Consumers' Price Index and the unemployment rate. In this study, Turnovsky develops a series of models for both short-term and long-term expectations reflecting the adaptive, extrapolative, weighted and rational expectations models (Turnovsky, 1970, pp. 1442-43). The data are taken over two periods, 1954 to 1964, and 1962-1969.

Turnovsky tests the validity of each of the implied expectations models by direct use of the micro data. Acceptance or rejection of a particular model rests on the agreement of the estimated parameters with their theoretical expectation and the overall ability of the model to accurately predict the actual price changes.

On the basis of his data and specified models, Turnovsky concludes

> "As far as the relative merits of the different expectations hypotheses are concerned, the evidence appears to favor the extrapolative scheme.",

and with respect to the rational expectations hypothesis, he concludes:

> ... these results suggest that the standard expectations hypotheses tend to be inconsistent with the assumption of rationality."

In a more recent use of the Livingston data, Pearce examines the question of rationality by using the individual forecasts of Standard and Poors Stock Index (SPI) as recorded by the Livingston Survey. His data base includes over 2000 observations on 6 and 12 month expectations. Two tests of the rationality assumption are presented. First, after adjusting for heteroskedasticity, the unbiasedness of expectations, a necessary condition, is tested by regressing the actual SPI value on the recorded expectation:

(14)... $A_t = a + b\ E_{t-1}[P_t]$

where At is the actual value and $E[\cdot]$ is the recorded expectation 6 or 12 months prior. Unbiasedness requires that a=0 and b=1. As set forth by Muth, this is a necessary although not sufficient condition which must hold for rationality.

Pearce estimated this equation for both forecast horizons and for three sub-periods of the data. He concludes:

> "...the hypothesis that the survey predictions are unbiased is strongly rejected... the survey predictions fail to satisfy the this necessary condition for rationality."

As an additional test of the hypothesis, Pearce examines the relationship between the forecast error and a set of macroeconomic variables which serves as the exogenous information set upon which the forecasts may have been based. Under the rational expectations hypothesis, this forecast error must be statistically independent of the variables in the information set. Leaving out possible relevant variables from the specified information set does not affect the validity of the test to reject the hypothesis. Any bias is in favor of the rationality hypothesis (Abel and Mishkin).

Applying this informational efficiency test to the Livingston data, Pearce concludes

> "This null hypothesis (rationality) is rejected at the 1 percent level for each measure of forecast error. ... In most cases, the forecast errors are significantly correlated with even the known past change in the stock price index itself. The results for the two sub-periods yield the same conclusion. Thus, the survey data strongly reject the hypothesis of rationality."

As a final example of a test of the rationality hypothesis, consider the recent applied work of Nerlove (1983). In this particular study, Nerlove argues that the question of the appropriate expectation model may be usefully addressed by a direct appeal to the data on micro observations as opposed to disentangling the expectations from a model of behavior. Nerlove uses direct observations on expectations and their realizations taken from surveys administered to German firms and French firms. Unlike other studies which have used micro data, the Nerlove study uses data which is categorical and not quantitative in form. The test of alternative expectations models is carried out by the application of a log-linear probability model to both the German and French data. With respect to the rationality hypothesis, Nerlove concludes

> "To the extent that firms make systematic errors and to the degree to which the relations between the ex ante and the corresponding ex post variables are stable over time, doubt is cast on the validity of the rational expectations hypothesis in its simplist form. ... Because of the categorical nature of the data, one should be cautious in interpreting these results as evidence against rational expectations, but the simpler forms of the hypothesis are clearly not supported."

Conclusions

Economists have been aware that economic agents anticipations of the future levels and/or rates of change in key variables influences their decision process. Early attempts to incorporate this notion into econometric models lead to hypotheses about how anticipations are formed which resulted in ad hoc specification of this complex process. Of major concern was the fact that the expectations models where fundamentally inconsistent with the structure of the econometric models being developed and used. This was manifest in the fact that the reduced form price equation generated from most simultaneous econometric models was not consistent with the price forecasting equation assumed to represent agents anticipations.

Muth presented an argument which did away with this inconsistency by replacing agents expectations with that of the reduced form equation from the econometric models at hand. Expectations formed in this manner were then consistent with the econometricians view of the world as specified by his models. Muth's argument was not that every agents expectation was formed in this rational manner, but that the average expectation across agents was an unbiased estimated drawn from the same probability distribution as the actual variable.

An outcome of Muth's work was incorporation of rational expectations into all sorts of economic modelling efforts. In addition, with the work of Lucas, sound policy analysis has become synonymous with the concept. This arose out of the observation that the structural parameters of the econometric model where not independent of the structural parameters of the truly exogenous variables in the system, many of which may be policy variables. Changes in the structure which generates the policy variables would require simultaneous changes in the parametric specification of the estimated econometric model. This was something that was not clearly understood (or at least articulated in the literature) prior to the exploration of the rationality hypothesis.

The purpose of this paper has been to hopefully elucidate the various aspects and claims made for rational expectations from the perspective of applied policy modeling. It has not been to decry the work presently being carried out in this area. Indeed, the work of Muth and Lucas have caused all econometricians and policy analysts to delve more deeply into the role played by anticipations in economics science. This will, I am sure, be recorded as one of the major advents in the field of economic science in this century.

However, it is also apparent from reading the literature, that substantially unfounded claims and uncritical applications of the rationality hypothesis are being made. I believe that it is imperative that we not embrace this hypothesis as axiomatic particularily in applied agricultural policy models. As the evidence presented in this paper suggests, the existence of rational expectations on the part of economic agents cannot be consistently supported. In fact, it is more than a little disconcerting that some agents are rational while some are not. I would argue that rationality if it exists as defined herein is a human condition which is not randomly distributed throughout various economic or social groups. Why are tomato producers in Florida and broiler producers in the U.S. 'rational' while escarole producers in Florida, investors in treasury bills, and policy makers, businessmen and professional economists and stockbrokers are not?

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